# Australasian Plant Conservation

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**Coastal 20 – $2.5 Million for the restoration of 20 iconic coastal wetlands in northern New South Wales and south east Queensland**

**The rehabilitation of coastal wetlands: why small-scale variations in microtopography are critical to success**

**The Bega Valley Shire's Coastal Weeds Project**

**Restoring Eastern Suburbs Banksia Scrub in Sydney's historic Centennial Parklands**

**WetlandCare Australia expands sustainable floodplain management across the Nambucca and Bellinger Catchments**

**And much much more…**

SPECIAL THEME: CONSERVATION AND RESTORATION OF COASTAL AND ESTUARINE ECOSYSTEMS

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***Australasian Plant Conservation***

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*Australasian Plant Conservation* is a forum for information exchange for all those involved in plant conservation: please use it to share your work with others. Articles, information snippets, details of new publications or research, and diary dates are welcome. **The deadline for the December–February 2012 issue is Friday 4 November 2011.** The theme for the issue is **Monitoring and plant conservation.** General articles are also very welcome. Please contact Selga Harrington if you are intending to submit an article: selga.harrington@gmail.com.

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**Front cover:** Beachcomber Holiday Park and north to the Tuross River estuary and South Tuross Beach from the air 2005. Photo: Beachcomber Holiday Park.

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# Contents



## Regular Features

# From the editor

*Selga Harrington*

*Parsons Brinckerhoff*

Welcome, readers, to the spring 2011 issue of Australian Plant Conservation. The theme for this issue is *Conservation and restoration of coastal and estuarine ecosystems*.

Australia's coastal environment is one of the most expansive and diverse in the world – with almost 60,000 km coastline it is one of the world's longest. The majority of the Australian population lives on or near the coast, with an astounding 85% of the population living within 50 km of the coast. Although much of the population lives within capital cities on the coast, many of Australia's coastal regions have experienced significant population growth in the last decade, generally in regions close to capital cities resulting in rapid and extensive growth and urbanisation.

This rise in population has resulted in greater pressures upon our coastal environments. Since European settlement, over 60% of southern Australia's coastal wetlands have been cleared with significant loss also in other coastal habitats, including important breeding habitats provided by mangrove forests. Biodiversity in a number of coastal areas is in decline and there are 17 nationally threatened ecological communities (listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*) occurring within 10 km of the coast.

Key threats to biodiversity in coastal areas explored within this issue include:

- vegetation clearing, particularly for urban expansion and agriculture
- activities leading to catchment degradation (e.g. pollution of waterways, activation of acid sulfate soils, erosion and sedimentation)
- altered flow regimes of rivers, streams, floodplains and wetlands e.g. low environmental flows, draining of wetlands, or artificial inundation for recreation
- weed invasion.

Climate change is likely to exacerbate existing threats to coastal biodiversity, particularly through the impact of rising sea levels, for example on coastal mangrove and wetland systems. However, the maintenance of coastal vegetation and wetlands is likely to provide some protection from the effects of sea-level rise and increased storm events as a result of climatic changes, particularly protection against coastal erosion.

While increasing development on the coast is threatening our biodiversity, the associated increase in population provides an increased pool of potential members for community groups involved in plant conservation activities. This issue includes numerous inspirational examples of effectively engaging community groups in conservation work and raising environmental awareness in the community through knowledge sharing.

Within this issue, you will learn about real examples of the valuable works being undertaken by conservation groups, individuals and the business and government community to tackle threats to coastal biodiversity. The articles range from broad strategies and programs aimed at conserving these ecosystems, to analysis of restoration techniques and specific on-ground works. They provide valuable insights into the visions and goals, challenges and successes of these coastal plant conservation and vegetation restoration projects.

The themed articles are followed by an article on Travelling Stock Routes (TSR). Originally established for droving sheep and cattle during early European settlement, TSRs now provide important refuges for a range of threatened species and ecological communities. This article summarises the outcomes of the 2011 NSW Travelling Stock Routes and Reserves Conference held in Orange in July and provides a taste of the issues to be covered in the ANPC workshop on managing native vegetation in TSRs. The next ANPC workshop will be held on 3 and 4 November 2011 in Armidale, NSW.

The issue concludes with an obituary for rainforest field ecologist, Anders Bofeldt. Anders is particularly well known for discovering and documenting new populations of rainforest species, thus contributing to our present understanding of rainforest species' ranges. Added to this are our regular features: Zoë Smith's report from the USA, Report from New Zealand Plant Conservation Network, Research Roundup; a book review, Information Resources and Useful Websites and Conferences.

This is an issue to inspire you to get involved, to try new techniques and to continue to learn!

# Coastal 20 – $2.5 Million for the restoration of 20 iconic coastal wetlands in northern New South Wales and south east Queensland

*Adam Gosling*

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## Introduction

Since colonisation coastal wetlands have been largely under-valued in Australia, leading to significant loss and degradation of these critical ecosystems. The environmental, social, cultural and economic values of coastal wetlands are only beginning to be fully appreciated by the wider community. Historic and current land use continues to seriously impact coastal wetlands with the flow-on effects having negative repercussions for the human, plant and animal communities that depend on them. In the highly populated coastline areas up to 90 per cent of wetlands have been lost since European settlement (Finlayson, 2000; Usback & James 1993) and increasing population places them under continual threat of loss or damage.

## The significance of coastal wetlands

Valued as a source of food, medicine and tools, coastal wetlands are of cultural significance to Traditional owners. Coastal indigenous communities often held ceremonies in these areas and many Aboriginal artifacts still remain despite wide-spread desecration. Traditional owners have carefully managed the wetlands to ensure their sustainability and protect their cultural values. They continue to maintain links to their country through stories, lineage, occupation and use.

Coastal wetlands directly benefit coastal communities by providing numerous services, including:

- groundwater replenishment
- shoreline stabilisation and storm protection
- sediment and nutrient retention and export
- water purification
- reservoirs of biodiversity
- nurseries for recreational and commercial fish species
- wetland products
- cultural values
- recreation and tourism
- climate change mitigation and adaptation.

These ecosystem services have been estimated to contribute trillions of US dollars worth of services each year worldwide to human health and well-being (Costanza et al., 1997). It is essential that the true dollar value of these services is recognised by decision makers and the community to ensure these vital ecosystems are fully appreciated and protected.

## The Coastal 20 Wetland Project

In WetlandCare Australia's 20th year of operation, they have embarked on an important initiative, the $2.5 million Coastal 20 Wetland Project, which is funded under the Australian Government's Caring for our Country program. This project will involve a range of on-ground, education and community engagement activities to undertake the restoration of 20 critical coastal wetlands that span 1000km of the northern New South Wales and south-east Queensland coastlines. The Coastal 20 project team is working with the community and key stakeholders to identify and prioritise the major impacts occurring at the 20 wetlands to develop innovative and sustainable solutions.

Management plans and a suite of management actions for each of the 20 sites have been developed through consultation and site assessments. Management actions identified during this process will bring about considerable environmental, cultural, social and economic benefits. Actions include:

- design and creation of constructed wetlands to improve water quality
- riparian restoration and re-creation to improve connectivity, repair bank instability and reduce sedimentation
- reinstate hydrology through drain infilling and in-drain structures to promote restoration of wetland vegetation and ameliorate impacts of acid sulfate soil
- increase the resilience of endangered ecological communities (EECs), threatened flora species and wetland vegetation by reducing threats including weed and feral animal invasion
- reduce impacts to native vegetation from excessive human or vehicular access
- protect and improve shorebird and migratory bird habitat through access restriction, rubbish removal and feral animal eradication
- install vegetative filter strips to mitigate sedimentation impacts from agriculture

- plant native food trees to improve resources for targeted fauna species
- improve carbon sequestration capacity of coastal wetlands by reducing anthropogenic impacts and reinstating natural hydrological regimes.

The primary focus of the Coastal 20 Wetland Project is on-ground works aimed at coastal wetland rehabilitation and protection. A range of complimentary community education and engagement activities designed to increase the effectiveness and sustainability of on-ground actions has been devised. Activities will focus on the promotion and protection of the environmental and cultural heritage values of coastal wetlands and increase the general awareness in the wider community of the importance of coastal wetlands and how, as individuals, we can help.

## Plant communities of the Coastal 20 Wetland Project

Coastal wetlands are home to some of Australia's most iconic and adaptive plant communities, including numerous threatened species and endangered ecological communities. The Project covers a broad geographic range and a wide variety of coastal wetland types that, in turn, support a diverse array of coastal plant communities, including marine vegetation such as mangals, saltmarsh and seagrass that provide vital fish nurseries, buffer our coasts from storms, sequester carbon and support habitat for migratory birds. Freshwater wetland refuges located along the coast contain a vast array of vegetation communities, including paperbark forests, aquatic macrophytes, floodplain communities, littoral rainforests and coastal vine thickets.

All these communities are flora biodiversity hotspots providing an essential link between inland wetlands, native vegetation ecosystems and coastal and marine environments. Despite this, they are under increasing threat. Historic and continued fragmentation compromising their natural resilience means they require careful management and sufficient resources to combat the threats. Maintaining the assemblages contained within these plant communities is paramount to halting the loss of species and coastal wetland ecological integrity.

## Conclusion

With such catastrophic loss of coastal wetlands and the continued threat of further loss, on-ground works to reverse the trend are essential if they are to survive and continue to function effectively. The Coastal 20 Wetland Project will go some way to protect these precious resources and the diverse range of plants and animals dependent on them for the ecosystem services and enjoyment of future generations.

For more information on the Coastal 20 Wetlands Project and how you can be involved please contact Adam Gosling at WetlandCare Australia or visit www.wetlandcare.com.au.


*The Coastal 20 sites span 1000km of the northern NSW and south east QLD coastlines.*

*The Comb-crested Jacana occurs on coastal freshwater wetlands and uses its long legs and exceptionally long toes to walk on aquatic vegetation. Photo: Adam Gosling.*

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# Conserving coastal wetland vegetation with WetlandCare Australia's Blue Carbon program

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## Coastal wetlands

Coastal wetlands, in particular mangrove forests, saltmarsh and seagrass have suffered massive losses globally. In developing countries, those that remain continue to face the threat of clearing for urbanisation and agriculture. In Australia mangrove forests, seagrass and saltmarsh are protected under state laws, however many of these types of coastal wetlands have already been lost and those that remain are threatened by factors such as the siltation of rivers and streams, physical damage, pollution and poor water quality. This is despite the fact that they provide vital food and habitat resources for numerous species of recreationally and commercially important fish species as well as providing a significant protective buffer from extreme weather events.

## Protecting and restoring coastal wetlands

Throughout its 20 year history, WetlandCare Australia (WCA) has used innovative methods to deliver on its commitment to protect, promote and restore wetlands. In this time, numerous projects have been undertaken to protect and rehabilitate coastal wetland vegetation, in particular saltmarsh, mangroves and seagrass meadows. These include:

- the rehabilitation of wheel ruts in saltmarsh beds and the prevention of unauthorised access
- weed and erosion control
- assessment of vegetation migration pathways in the face of sea level rise
- the reinstatement of natural hydrology.

WetlandCare Australia's range extends well into upper catchment areas where rehabilitation actions, such as erosion control, are a vital component of helping to protect downstream seagrass beds from being smothered with sediment from catchment runoff.

## Wetlands and climate change

As well as their role in helping to take up and store carbon, healthy coastal wetlands are critical in mitigating some of the likely predicted effects of climate change. Coastal wetlands are able to protect shorelines, and subsequently coastal communities, in the face of extreme weather events. This is of great importance, as severe weather events such as storms and cyclones are predicted to become more frequent. The effects of climatic extremes such as increased drought and fire frequency, and changes in rainfall patterns are all likely to impact on coastal wetlands. Ensuring these ecosystems are functional and healthy is crucial to maintaining ecosystem resilience.

## Blue carbon

There is an exciting field of research emerging that has added new weight to the existing case for the conservation of coastal wetlands. A seminal report published in 2009 called *The Management of Natural Coastal Carbon Sinks* (Laffoley and Grimsditch 2009) brought together the latest research into the carbon sequestration capacities of key coastal ecosystems. This was then followed by the *Blue Carbon Rapid Response Assessment Report* (Nellemann *et al*. 2009) which highlights the critical role of oceans and ocean ecosystems in maintaining our climate.

When it comes to carbon sinks, tropical rainforest like the Amazon is usually the first type of environment that springs to mind. This new research however, has shown that the carbon sequestration rates of coastal wetlands are actually much higher than those of terrestrial systems.

*Eroding salt marsh at Lake Coombabah, Qld. The high amounts of carbon in these soils are evident as the colour difference between the dark mud of the saltmarsh and the lighter coloured sand. Photo: C. Bolzenius, WCA.*

Conversely, the destruction of these wetlands is contributing a disproportionate amount of carbon dioxide ($CO_2$) into the atmosphere and these systems continue to emit $CO_2$ for years after their destruction. In addition to the many established ecosystem services that these types of coastal wetlands provide, their role as significant carbon sinks is now being realised.

There are schemes underway in Australia that aim to utilise the ability of natural systems to take up carbon to offset greenhouse gas emissions. WetlandCare Australia is Australia's leading not-for-profit wetland conservation organisation, and thus the idea of the introduction of a market based mechanism that provides a financial incentive to landowners for restoring coastal wetlands is a very appealing prospect. WetlandCare Australia's Blue Carbon program was launched in 2010. The overarching goal of this program is to promote the Blue Carbon agenda in Australia and work towards the inclusion of coastal wetlands in Australia's climate change adaptation and mitigation strategies.

This is being accomplished by establishing partnerships with universities to facilitate and guide key research priorities in this emerging field, and by fostering the recognition of the role of coastal wetlands in the voluntary carbon market and their potential contribution towards Australia's Kyoto obligations. WetlandCare Austraia is also continuing to work towards the ongoing rehabilitation of key coastal wetland environments, particularly through the $2.5 million Coastal 20 Wetlands Project funded under the Australian Government's Caring for our Country program. This project will effectively address connectivity at a regional scale by covering 1,000 kilometres of the eastern seaboard, and building resilience in the face of climate change.

Losses of coastal wetlands have been high globally. Many of those that remain are in developing countries. The challenge for international authorities is to develop a market based mechanism that provides financial incentives for these communities to conserve these ecosystems in the face of threats from population pressures, development and agriculture. In Australia, it has been estimated that in highly populated areas the loss of wetlands has been as great as 90% and those that remain are now almost all protected. The challenge is to develop and use these market based instruments to provide a financial incentive to restore the coastal ecosystems that remain, and reinstate those that have been lost.

*Healthy mangroves and saltmarsh at North Creek, Ballina, NSW. Photo A. Gosling, WCA.*

### Working towards offsetting greenhouse gas pollution

Who knows how much carbon is locked up in Australian coastal wetland plants and soils? Who knows how much carbon may be able to be drawn out of the atmosphere if large scale coastal wetland restoration projects were to be undertaken in otherwise marginal areas? WetlandCare Australia will continue to pursue opportunities to answer these questions, as well as working towards the development of a method that will allow an economic value to be placed on the important role that coastal wetlands play in offsetting greenhouse gas pollution.

'Targeted investments in the sustainable management of coastal and marine ecosystems – the natural infrastructure – alongside the rehabilitation and restoration of damaged and degraded ones, could prove a very wise transaction with inordinate returns'.

Achim Steiner UN Under-Secretary General and Executive Director, UNEP 2009

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# WetlandCare Australia expands sustainable floodplain management across the Nambucca and Bellinger Catchments

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## The Sustainable floodplain management program

The Nambucca and Bellinger Catchments on the mid-north coast of New South Wales contain expansive areas of coastal floodplain wetlands. These wetlands form a connected link across the low-lying landscape, and support critical environmental services fundamental to the health and productivity of the region and its communities. The Sustainable Floodplain Management in the Nambucca and Bellinger Catchments Program (hereafter "the Program") implemented by WetlandCare Australia was established to address a spectrum of problems that impact these coastal systems. The Program set a three-year objective to engage a representative range of stakeholders with a common goal of best practice management of floodplains in the context of sustainable agriculture.

The value of coastal floodplain wetlands for biodiversity, commercial industries, tourism as well as recreation is well established. Through the Program WetlandCare Australia utilised its specialist knowledge and experience to raise community awareness about the importance of wetlands and their wise use. The Program was financially supported through the Australian Government's Caring for Our Country Program.

## The importance of coastal floodplain wetlands

A key objective of the Program is to promote the range of ecosystem services and functions that coastal floodplain wetlands provide within the environment. Wetlands act to filter and capture pollutants, sediments and nutrients from waterways, enhancing water quality and supporting biodiversity. Many fish and waterbird species rely on the food, nursery habitats and breeding grounds that wetlands provide, particularly in times of drought. Wetlands also act to release oxygen and store carbon dioxide—an increasingly valuable function in a changing climate. Carbon sequestration is particularly important in minimising greenhouse gas concentrations in the atmosphere. As well as the environmental benefits that wetlands provide, they also support many commercial and non-commercial industries including oyster farming, fishing, agriculture, tourism and leisure sports.

## A history of floodplain farming in the Nambucca and Bellinger catchments

The floodplains and riverine systems of the Nambucca and Bellinger catchments have long been recognised as areas of productive agriculture for dairying, cattle grazing and horticulture. However farming of these low-lying areas has never been free from challenge. The late 1940's and 1950's saw significant flood mitigation works, including the construction of extensive drainage networks undertaken to provide farmers with the relative security needed to establish productive farms.

It was not long before adverse impacts from floodplain drainage began to cause significant problems. As well as reducing the impacts of flooding, the mitigation works also developed a drainage network that sought to remove water from even the lowest, wettest and swampiest areas of the floodplain. Many of these areas simply turned to dust as acid formed and scalded the surface. Presently, land, vegetation, soil and water are still greatly impacted by this drainage.

Resolving problems caused by past drainage, clearing and intensive grazing are a key focus for farming communities. Many farmers are seeking best management practice to improve the environmental values of the floodplains whilst achieving increased farm productivity.

## Floodplain farming issues

Floodplain landscapes and varying climatic conditions contribute to a wide range of issues that require individual planning, assessment and management. A central principle in the Program is encouraging landholders to work within the natural capacity of the land with a view to achieving sustainable and economically viable farm management. Through the Program, WetlandCare Australia has been able to engage a number of key floodplain landholders and community groups with a range of solutions to significant floodplain farming and natural resource management problems. For example:

- drainage and acid sulfate soils—focusing on implementing best practice floodgate management and controlling seasonal water levels in low-lying backswamps to reduce the exposure of acid sulfate layers

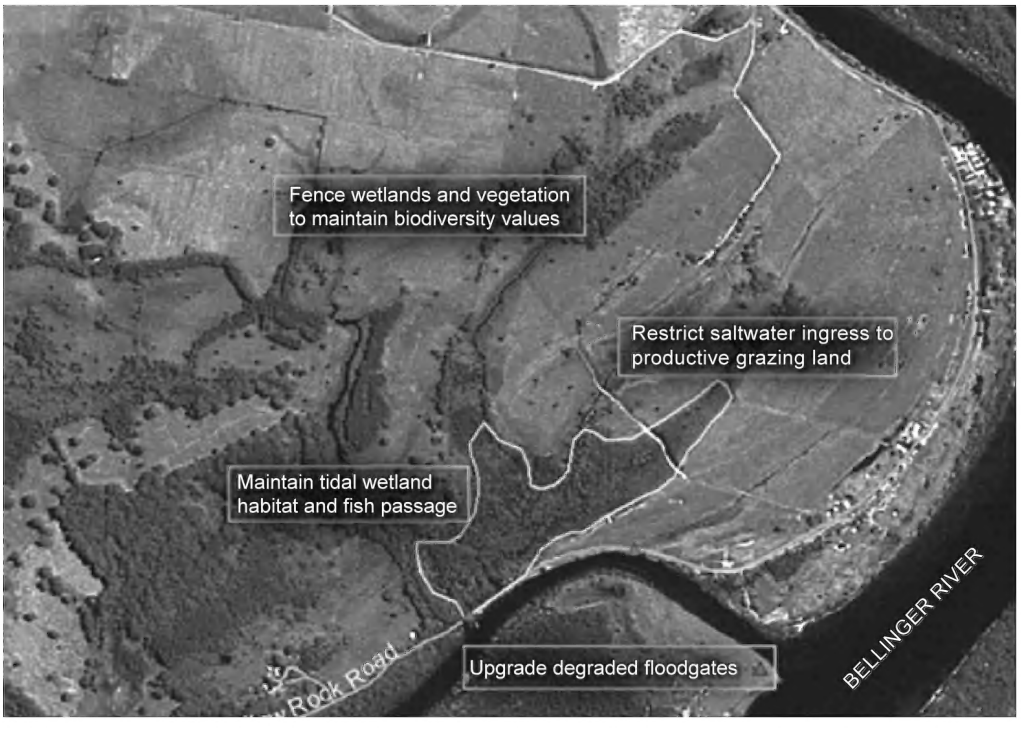
- aquatic and riparian weeds—focusing on planning and implementing an integrated weed control strategy
- sustainable grazing practices—focusing on taking advantage of seasonal grazing opportunities including establishing wet pasture and introducing sustainable grazing regimes, for example cell or rotational grazing
- riparian health and stream bank erosion—focusing on managing existing native riparian vegetation and revegetating exposed banks
- fish passage and habitat—focusing on improving aquatic environments including water quality and habitat connectivity.

### Successful outcomes

Although challenged by severe flooding and continuous wet weather throughout the three years of the Program, the engagement with a diverse range of floodplain landholders and stakeholders in sustainable land management is an outstanding achievement that meets the overall objectives of the Program. As well as this high level of community engagement, WetlandCare Australia is working with over ten key landholders to develop comprehensive property plans and implement on-ground works that see positive outcomes for both the environment and agriculture. Examples of on-ground landholder partnership projects as part of the Program include:

- upgrading stock crossings (installation of a permanent hard-base laneways) to reduce sedimentation, contamination and high nutrient loads from entering the waterway on-site, which also provides benefits downstream
- implementing best practice drainage strategies to ensure backswamps remain wet during dry seasons, reducing exposure of acid sulfate layers and providing native wet pasture for seasonal grazing
- revegetating artificial drainage lines to reduce in-drain weeds and provide shade and wind protection for stock
- replacing conventional floodgates with 'fish friendly' float gates to allow for better fish passage and controlled tidal movement
- restricting cattle access to wetland areas to improve water quality, habitat and reduce bank erosion.

In implementing these on-ground works WetlandCare Australia, with funding from the Australian Government's Caring for Our Country Program, will expand community awareness of the multiple values of best practice floodplain management to achieve enhanced environmental health, sustainability and farm productivity. Positive, overlapping benefits and improvements to agricultural production, commercial and recreational fishing industries, and ecological values such as water quality, wetland habitats and aquatic biodiversity are key components contributing to the success of the Program. For further information on the Sustainable Floodplain Management in the Nambucca and Bellinger Catchments Program please contact WetlandCare Australia, the leading Australian not for profit wetland conservation organisation at www.wetlandcare.com.au.




*General natural resource management concepts across a floodplain landscape.*

# The rehabilitation of coastal wetlands: why small-scale variations in microtopography are critical to success

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## Introduction

Coastal wetlands are potentially subject to a range of threats and stressors; many suffer from altered water regimes and the loss of native vegetation and are in need of rehabilitation.

Since 2003 we have been running a large, multidisciplinary project to rehabilitate the brackish-water wetlands that fringe the Gippsland Lakes in south-eastern Australia. These wetlands, although recognized as regionally, nationally and internationally important and listed under the Ramsar Convention, are threatened by a wide range of environmental factors, including highly unnatural water regimes, secondary salinization, nutrient enrichment, and the presence of acid sulfate soils (Boon et al. 2007).

The focus of our studies has been Dowd Morass, a large (1,500 ha) brackish water wetland near the confluence of the Latrobe River and Lake Wellington, at the western end of the Gippsland Lakes complex. The dominant vegetation is Swamp Paperbark, *Melaleuca ericifolia*, which covers about two thirds of the vegetated area of the wetland. Large swards of Common Reed *Phragmites australis* also occur but their extent has declined over recent decades (Boon et al. 2008).

Dowd Morass suffers from chronic inundation and has been kept artificially inundated since the mid 1970s, in order to provide for duck-hunting opportunities, facilitate breeding by the colonial nesting birds, and limit intrusions of saline water from the Gippsland Lakes (which are connected to the Southern Ocean by a permanent entrance at the township of Lakes Entrance). The result has been water levels that are unnaturally high and fluctuate over only a small range, and so the periodic drying events that would have occurred in the past either no longer occur or are exceptionally rare. Accordingly, the plant communities are floristically depauperate and mostly in poor condition. The application of a drawdown phase, where water levels are reduced to expose sediments and then allowed to fluctuate more naturally, is a management tool often thought to be suitable for rehabilitation and rejuvenation of chronically inundated wetlands.

## Rehabilitation of Dowd Morass

The research project had two main components: i) to determine the hydrological requirements of the main plant species present, particularly Swamp Paperbark; and ii) to trial different strategies to rehabilitate the wetland, centred on a whole-of-wetland hydrological intervention to see whether the introduction of a more natural wetting and drying cycle would improve vegetation condition. When the hydrological manipulations commenced in 2003, the wetland's vegetation was in poor condition: adult plants were dying; there was little sexual recruitment of juveniles into the population; and the understorey was floristically very poor (usually fewer than two or three species).

Dowd Morass was suitable for hydrological manipulations because in the 1970s it had been divided into two regions by a substantial north-south levee. The levee allowed us to drain the westerly part (~500 ha) and to maintain water levels in the easterly part (~1,000 ha) in a modified Before-After/Control-Impact (BACI) experimental design with impact, control and reference sites. Water levels were controlled with two large agricultural pumps, which pumped water from the drawdown side into the Latrobe River and across the levee into the control site, supplemented by opening or closing the gates on a large regulator that linked the wetland with the river.

*Mounds of dead Common Reed in Dowd Morass at low water level, showing the complex variations they create in sediment microtopography. Photo: Paul Boon.*

### Importance of microtopographic relief in establishing different water regimes

We assumed that a single water regime could be applied and that it could be modified at a whole-of-wetland scale by pumping and/or regulator control. However, we were unable to maintain a single consistent water regime due to prolonged drought, combined with three severe storms that flooded the site, and vandalism of the regulator used to control the influx and efflux of water. Instead, we used hydrological classifications to determine whether different water regimes operated at smaller spatial scales. To support the hydrological analyses, we had detailed, long term (4 year) data sets on water levels and floristics from forty-five 50 m transects across the wetland. The hydrological classification, prior to hydrological manipulation, showed that, despite the wetland being nominally permanently inundated, subtle variations in microtopography created four distinct water regimes and this hydrological heterogeneity (variability) subtly controlled vegetation patterning (Raulings et al. 2010). Causes of microtopographic variation included hummocks created by dead clumps of *Phragmites australis* and other types of grassy wetland vegetation (e.g. *Paspalum* spp.), and raised areas around the emergent trunks of Swamp Paperbarks.

We re-analysed the hydrological data to see whether the original small-scale water regimes had been maintained after the hydrological interventions (Raulings et al. 2011). The interventions had simplified the range of hydrological regimes that occurred in the wetland, and there were now three distinct water regimes: i) areas that continued to be permanently inundated with deep water; ii) areas that were flooded intermittently but only with shallow water; and iii) areas that had almost completely drained. Floristic richness of the understorey improved in the drained sites with 12–15 understorey species per 50 m transect, compared with <5 (often only 1–2) in permanently flooded sites.

### Conclusions

We concluded that the capacity of wetland vegetation in Dowd Morass to respond to a reinstatement of drying following chronic inundation was constrained by abiotic (e.g. salinity and sediment pH) and biotic (e.g. depauperate seed banks) factors. The whole-of-wetland manipulations that we tried were complex, expensive and risky. Moreover, such interventions may not always improve vegetation condition, at least in the short term. Our trials showed that rehabilitation was most successful in areas that had been shallowly flooded prior to drawdown and that remained dry for longest.

Studies across the world show that microtopographic relief plays a major role in wetland ecology and rehabilitation (Larkin et al. 2006; Raulings et al. 2010, 2011). Topographic microheterogeneity is likely to be critical for the health of coastal paperbark-dominated wetlands in south-eastern Australia, given that *Melaleuca* spp tend to dominate poorly drained ground of low fertility: under these conditions, the drier, less saline and nutrient-enriched hummocks they create are essential precursors to environmental heterogeneity in the wetland. It is likely, therefore, that the success of future attempts to re-instate more natural wetting and drying regimes would be improved by considering the wetlands not as homogeneous (uniform) basins with a single water regime, but instead as a complex mosaic of subtly different water regimes and vegetation patterns. With clever control of water levels, it may be possible to take advantage of such microtopographical heterogeneity to increase floristic richness in the understorey and improve the condition and recruitment success of the overstorey in tree or shrub dominated wetlands.

*One of the large agricultural pumps used to drain Dowd Morass. Photo: Paul Boon.*

### Acknowledgements

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# The Moolapio Project – a land management program conserving and enhancing coastal foreshore and wetland communities at Point Henry

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## Background

Greening Australia (GA) is a not-for-profit organisation dedicated to the protection and restoration of native vegetation in Australia. GA maintains a strong community focus, believing that real landscape change can only occur with widespread community support. More recently, Greening Australia has identified the need for a more strategic approach to land management, one that combines the best scientific knowledge available with careful planning to produce the best restoration outcomes.

## Project vision

Alcoa has produced aluminum at its Point Henry smelter 5 km from Geelong (Victoria) since 1962. In 2006, GA Victoria prepared a Land Management Plan (Koch 2006) for the 540 ha of Alcoa's Point Henry operations. This area comprised a diverse range of landforms from rare foreshore habitats, to expansive saline and freshwater wetlands, to agricultural land. Each offered a range of possibilities for conservation, and enhancement while posing numerous land management challenges. Entitled 'Moolapio' (which is the traditional title for the area of the Wathaurong people) the project focused on environmentally sensitive land management and community engagement. The outstanding natural features at the Moolapio site and a long term commitment by Alcoa, allowed GA to combine ingredients of ecologically rigorous planning, science-based restoration practice and evaluation and a diverse approach to community engagement, to effect significant conservation and landscape change.

## Challenges and successes

Alcoa's Point Henry occupies a large proportion of a peninsula that juts into Corio Bay, which itself comprises one of several bays to the southwest corner of Port Phillip Bay. The Point features low topography, sheltered bays and calcareous soils which host extensive foreshore saltmarsh vegetation in broad depressions behind narrow low dunes. These areas provide important habitat for a range of fauna including migratory birds of international significance. The saltmarsh vegetation depends on once or twice-yearly "king tide" events which inundate the area with fresh seawater. Several vegetation types occur within this community including *Atriplex cinerea* Coast Saltbush Shrubland, Coastal Saltmarsh Complex, Coast Saw-sedge Sedgelands and Coastal Shrubland/Woodland Complex.

A network of saltwater ponds has been created by engineering works behind the fore dune system. This pond system creates a similar habitat to the foreshore, with the bunds (levee banks that separate the salt ponds) simulating the low dunes of the foreshore. An automated pumping system regularly flushes seawater through the system (simulating a tidal event) producing a drawdown effect similar to that of the intertidal zone of the foreshore. This exposes mudflats that are rich in small shells and macroinvertebrates providing food and habitat utilized by migratory shorebirds such as the Australasian bittern, the fairy tern, Latham's snipe and the royal spoonbill. Moolapio is also located in close proximity to four Ramsar-listed sites (Limeburners Bay; Corio Lake Connewarre State Game Reserve; Swan Bay Port Phillip Heads Marine National Park, and; the Werribee wetlands) seeing it provide important natural connectivity in a fragmented, urbanized and industrialized landscape.

To treat surface water run-off from the plant's operations a series of storm-water drains and channels have been created to transport captured water to wetland-holding areas. These artificial freshwater wetlands were intended as biological filters to remove any potential pollutants before the water was discharged into the ocean. These artificial drainage channels and wetlands have become important

*An image of some of the coastal vegetation being managed through the Moolapio project. Photo: Paul Gibson-Roy.*

habitats in their own right, creating estuary-like conditions that support small fish, shrimp, macroinvertebrates (particularly amphipods) and the birds that feed on them (particularly egrets and herons).

The main goal of management actions related to these foreshore and wetland areas was to enhance the quality of vegetation and protect the habitat frequented by Ramsar-listed and other avifauna. Human disturbance was identified as among the major negative impacts to the coastal foreshore and associated wetlands. While passive recreational use of the foreshore was encouraged by both the City of Greater Geelong (COGG 2006) and Alcoa, a number of actions including uncontrolled vehicular access (damaging vegetation and dune systems), dog walking (and faeces deposition), rubbish dumping and shooting activities were considered inappropriate. In addition, weed and vermin control were also undertaken as priority land management actions.

Freshwater wetlands at the site underwent extensive works in 2008 to reduce and control the presence of Cumbungi (*Typha domingensis*), a native species that had spread and dominated within these areas, impacting negatively on floral and faunal communities. It also greatly impeded water flow, greatly reducing the effectiveness of the system as a bio-filter. Site amelioration included engineering works to remove the Cumbungi and to deepen and widen the channels thus improving water flow and creating unfavourable conditions for Cumbungi. 'Spoil' removed from these remedial actions was contained on site and extensively planted to indigenous species which thrived in these nutrient rich conditions. The insertion of large numbers of plants into the spoil and damaged or weed infested areas increased the diversity of native flora, improved habitat for fauna and provided strong competition with exotic weeds such as hairy willow herb and aster weed. To compliment these actions, a viewing platform and stairs were installed, creating easier public access to the restored area. Interpretive signs promoting conservation values and the upgrading of walking tracks within the zone also contributed to re-invigoration the freshwater wetlands (and coastal saltmarsh) for visitors.

*Excavator removing Cumbungi and deepening a channel. Photo: Rod White.*

## Community engagement

A critical component of Greening Australia's vision for Moolapio was that it would help raise environmental awareness for the broader community. In addition to support from Alcoa, GA received Federal Government Caring for our Country funding to undertake community training and education programs with tertiary institutions (University and TAFE), primary and secondary schools, and indigenous groups. These programs enabled regular engagement with community, covering a broad range of learning activities and events.

Community outreach programs increased knowledge and awareness of the local faunal and floral ecosystems associated with the Point Henry area. They have also helped to foster a sense of connection with the Point Henry site, with the community welcoming the opportunity to contribute to a uniquely local environmental project. For Alcoa staff, it provided an opportunity to contribute to an on-ground environmental project with other staff and the broader Geelong community.

Greening Australia and Alcoa's history of partnership dates back to 1982, and has involved numerous projects and community collaborations – all aiming to enhance and protect Australia's environmental assets. This relationship created the opportunity under which the Moolapio project was conceived, resulting in further positive environmental and social outcomes. To date, Moolapio's achievements have received considerable local and wider recognition including a United Nations Association Australia (UNNA) World Environment Day award in 2008 (Category: Best Specific Environmental Initiative) and a Victorian Coastal Award for Excellence in 2010 (Category: Coastal Planning and Management) while another aspect of the larger Moolapio project, focusing on the reconstruction of species-rich grassy-woodland, was a finalist in the UNNA's World Environment Day awards in 2009 (Biodiversity category). This year the Moolapio project was awarded 'Runner Up' from 57 international entries in the Alcoa Global Impact Awards (Category: Community Engagement). Moolapio's vision for the coming years is to continue to consolidate land management actions that improve the health and resilience of the flora and fauna associated with Point Henry, creating an environmental asset which is valued and enjoyed by the people of the Geelong Region.

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# Restoring Eastern Suburbs Banksia Scrub in Sydney's historic Centennial Parklands

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## Introduction

Eastern Suburbs Banksia Scrub (ESBS) is a sclerophyllous heath/scrub community occurring on nutrient poor aeolian sand deposits in the Sydney Basin bioregion. The characteristic assemblage of plants in the ESBS community includes *Banksia aemula, Banksia ericifolia, Banksia serrata, Eriostemon australasius, Lepidosperma laterale, Leptospermum laevigatum, Monotoca elliptica* and *Xanthorrhoea resinifera*. ESBS is listed as an Endangered Ecological Community under the New South Wales *Threatened Species Conservation Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. These listings recognise the significance and vulnerability of ESBS and provide legislative mechanisms for its protection.

ESBS once occupied approximately 5,300 ha of land between the eastern Sydney suburb of La Perouse and North Head at Manly. Today the ESBS community is restricted to an area of approximately 138 ha (<3% of its original area) and currently exists as a number of small isolated and fragmented remnants in a highly urbanised environment. ESBS is found on a variety of land tenures including national parks, golf courses, residential land, and within Sydney's historic Centennial Parklands, which is the focus of this paper.

The Centennial Park and Moore Park Trust (CPMPT) is responsible for management of the ESBS within Centennial Parklands. Centennial Parklands is located 5 km southeast of Sydney's central business district and occupies an area of 360 ha. CPMPT is responsible for the management of six stands of ESBS that remained after the urbanisation of eastern Sydney. Two of these remnants (totalling an area of approximately 2 ha combined), known as the Bird Sanctuary and York Road, are the largest remnants under the authority of CPMPT. These remnants have been subject to restoration works since 2004 and are considered best practice demonstration sites for effective restoration of ESBS (see NSW Department of Environment and Climate Change 2009a).

## Management issues and challenges

Historically, the ESBS remnants in the Centennial Parklands have been subject to planting of non-ESBS species including *Araucaria cunninghamii*, *Ficus* spp. and *Pinus* spp. Competition from these and other planted trees, shrubs, climbers and herbaceous weeds is the most significant threat to the ESBS. Shading of ESBS vegetation from plantings, weeds, and from late successional stage ESBS species (i.e. *Leptospermum laevigatum*) is also an issue.

*Volunteers working to restore the York Road remnant. Photo: Samantha McDonald.*

Because of the isolation of the ESBS remnants and their location within an urban environment, significant modification of natural ecological processes has occurred. The absence of fire has had a large impact and has resulted in reduced species diversity. It is unknown how viable and diverse the seed bank is; however, bushland regeneration works have promoted the growth of ESBS species from the soil seed bank in some areas. The abundance and diversity of fauna species that would have acted as pollinators and seed dispersers has also been reduced, affecting pollination and seed dispersal.

The main animal pests are rabbits and foxes. *Phytophthora cinnamomi*, an oomycete (water mould), is a potential threat to the ESBS remnants and has been recorded in Centennial Parklands. Uncontrolled access may lead to degradation of the remnants through trampling of regenerating ESBS seedlings, spread of weed species and *P. cinnamomi*, track proliferation and erosion, dumping of rubbish, and unplanned fires. Only the Bird Sanctuary and York Road are fenced and largely closed to public access.

### Management actions and goals

A Vegetation Management Plan (VMP), recognised as best practice by the NSW Office of Environment and Heritage (see NSW Department of Environment and Climate Change 2009a), has been prepared for the ESBS remnants in Centennial Parklands to direct restoration works. The VMP ensures that the best practice standards (see NSW Department of Environment and Climate Change 2009a) and methodologies (see NSW Department of Environment and Climate Change 2009b) are followed.

The management actions outlined in the VMP are in most cases not prescriptive, realising that management of the ESBS community must be adaptive and that the management of natural resources is experimental. The goal of the management actions is to directly mitigate the impacts and threats to ESBS in Centennial Parklands while considering the constraints imposed by the urban environment. Management actions include:

- weed control to reduce the extent of weeds and promote suitable conditions for regeneration of native species
- supplementing natural regeneration with appropriate planting of ESBS species
- controlling pest species including rabbits and foxes and minimising access
- testing for the presence of *P. cinnamomi*
- controlling pedestrian access
- managing unplanned fire and implementing ecological burns
- providing information to the public about the importance of the ESBS remnants and the restoration works.

*Volunteers creating vegetation piles for an ecological burn. Photo: Samantha McDonald.*

### What has been achieved?

Prior to any bushland regeneration works in the ESBS remnants, the vegetation structure varied from open forest in areas where non-ESBS trees (e.g. *Pinus* sp.) were planted and open to closed scrub/shrubland in the remaining areas dominated by exotic shrubs including *Olea europaea* subsp. *cuspidata* and *Lantana camara*. The vegetation was also simplified with few late successional stage ESBS species (e.g. *Leptospermum laevigatum*) dominating.

The ESBS remnants in Centennial Parklands have undergone a considerable transformation since bushland restoration works began in 2004. The work of the Centennial Parklands staff, volunteer groups, Green Corp Teams, and professional bushland regeneration contractors has resulted in relatively weed free ESBS remnants that display a significant amount of natural regeneration. With the exception of ongoing maintenance works to treat annual weeds, the ESBS remnants are now relatively self-sustaining. The activities completed so far have included:

- thinning the canopy of planted trees and removing the exotic and non-endemic shrub layer resulting in reinstatement of typical ESBS vegetation structure
- ongoing treatment of exotic climbers and groundcovers
- culling juvenile *Leptospermum laevigatum* to prevent the dominance of this species
- raking back the leaf litter layer to expose the soil surface and encourage seed bank germination
- soil stabilisation works to slow water flow and prevent erosion
- piling debris from weeding works for ecological burns
- creating access tracks to direct the movement of workers and visitors to prevent disturbance, soil compaction, and trampling of seedlings
- erecting a fence around the remnants to exclude pests and unauthorised human access.

Currently, weed density and abundance is low within the ESBS remnants in Centennial Parklands and a large amount of natural regeneration is occurring. These restoration works play an important part in the conservation of the ESBS community and will ensure that ESBS is retained within Centennial Parklands for its inherent value and for the enjoyment, education, and benefit of future generations.

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# The Bega Valley Shire's Coastal Weeds Project

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The Bega Valley Shire's Coastal Weeds Project commenced in July 2007 and is still continuing. It is an effort to integrate, support and intensify a range of activities to control and raise community awareness of the impact of environmental weeds along the Shire's coastline that extends about 125 km from Wallaga Lake to Cape Howe, at the state border. It is the coolest, driest, most southerly and most sparsely populated section of the NSW coastline.

There is great geological and geomorphological diversity, with lengthy dune-backed beaches, stretches of rugged cliffs and rocky headlands, and numerous intermittently open lagoons and tidal estuaries. A comparable diversity in natural vegetation types is present, ranging from subtropical and warm temperate rainforests to heath, salt marsh and the predominant dry eucalypt forests. The greater proportion of the coastal native vegetation has never been cleared for agriculture or otherwise much modified by European settlers. About 70% of this coast is conserved in national parks.

Coastal settlement is largely confined to Bermagui, Tathra, Merimbula/Pambula and Eden, each embedded in the national parks. The Shire has a small resident population of about 30 000 with a low average income. As a result the Council has limited resources to invest in weed control and the number of potential volunteers is low. The local Koori population is disadvantaged by poverty and high levels of unemployment. Tourism is the most significant local industry by turnover and employment and the coast is the key attraction for visitors.

## The project

Viewed from an economic perspective the project is about caring for the region's key economic asset. From an environmental perspective it is about conserving one of the finest stretches of coastline in south-eastern Australia.

The Southern Rivers Catchment Management Authority (CMA) has played a key role in obtaining and providing funding and in overseeing the project. Council, the National Parks and Wildlife Service (NPWS) and local volunteers have also made major contributions. The steering committee comprises all major local natural resource managers—the Southern Rivers CMA, Bega Valley Shire, NPWS, Lands Department, Far South Coast Landcare, as well as representatives from Victoria and the neighbouring shires to the north. Its 'whole-of-landscape' perspective is key to the project's success.

## Assessing the problem

The first stage was to determine what environmental weeds we have, where they are, which are the most threatening, the most effective techniques to tackle them, and what work was already under way. Local botanist Stuart Cameron, appointed project officer, undertook the survey and prepared a report. The findings were conveyed to agencies and the community in a series of meetings which endorsed its recommendations.

About 90 invasive species are having a significant impact locally, falling into three groups. Species dispersed by ocean currents, particularly Sea Spurge (*Euphorbia paralias*) and Beach Daisy (*Arctotheca populifolia*) threaten local beaches and are present, usually in low numbers, on almost all of them.

Two significant local weed problems Bitou (*Chrysanthemoides monilifera* subsp. *rotundata*) and Marram Grass (*Ammophila arenaria*) result from ill-conceived policies of government agencies who advocated planting them in the past. Both are capable of wholly displacing local native vegetation.

*Signs have been provided at three key sites infested with garden escapees. These picture escapees visible at the site, show where they originated and provide information on responsible gardening and disposal of garden waste. Photo: Stuart Cameron.*

Fully 80% of local environmental weeds are garden escapes. Spread mainly by dumping and garden overflow, these species are moving out into native vegetation from the periphery of all coastal settled areas. Overall, thus far, the impact of these garden escapes is negligible along the greater part of our coast. However the entire coastline is threatened over the longer term since they have well established bridgeheads around all coastal settlements and at abandoned farm sites embedded in national parks. We already have weeds capable of thriving in all the major coastal habitats—beaches, dunes, salt marshes, cliffs, dry ridges, and rainforests.

Climate change will expose us to new threats, such as lantana which is currently a very limited local problem due to its frost sensitivity but with a major infestation established just over the northern border of the Shire.

The key finding of the benchmark survey is that we have a great, but fleeting, opportunity to prevent an environmental weed take-over on the Far South Coast.

*Bitou (*Chrysanthemoides monilifera *subsp.* rotundata*) can smother native vegetation along coastal dunes. Photo: M. Fagg.*

## Tackling the problem

The project provides for work by professional contractors and for regular six-monthly 'sweeps' along the coast by teams of workers from the three local Aboriginal Lands Councils. These work crews search and weed all beaches as well as working on peri-urban sites nominated by the various local volunteer groups. The main species controlled are Sea Spurge, Beach Daisy, Bitou, Asparagus ferns (*Asparagus* spp), arums (*Zantedeschia aethiopica*) and milkworts (*Polygala myrtifolia*, *P. virgata*).

We have achieved a significant reduction in weed prevalence since the project commenced and the Koori workers are deservedly proud of their achievements. Boosted by this support, local volunteer groups have been able to move part of their efforts from weed control to planting and rehabilitation.

Raising awareness of the environmental weed problem and its causes is a major challenge and an important part of the project. The problem is primarily located in human values, attitudes, beliefs and behaviours, and we need to deepen and widen community engagement about all aspects of it, from garden plant promotion and selection through to disposal of garden waste and control of those species which have already escaped.

We tackle awareness raising on many fronts, including placing articles in local papers and talking to community groups and local agencies to equip gardeners with the skills to assess a garden plant for potential invasiveness, assess the riskiness of their garden, how it sits in the landscape, and how likely its plants are to escape.

We run 'weed walks' to show what is happening in local landscapes, introduce participants to potentially invasive plants and how garden plants escape into the landscape, and show how weeds vary in their impact and may be prioritised in control programs. The walks help give participants a sense of the totality of the landscape beyond their own properties and allow concerned locals to meet and form connections which can lead to the formation of new volunteer groups.

Our 'Unintended Gardens' signage is an innovative approach where we have installed signs at garden escape infested sites at each of our coastal settlements. They picture escapees visible at the site, show where they originated on a world map, and exhort the reader to responsible gardening and disposal of garden waste.

## Conclusion

We feel our project provides a model for effective use of the sparse resources available to control the spread of environmental weeds into native vegetation along the Far South Coast. It delivers both environmental and social benefits, including Koori employment, and has achieved some impressive results on the ground in only four years. Even so its future is far from secure. A few years inattention due to funding cuts would very easily see the weeds reclaim all that we have gained. But we have proven that a take-over by environmental weeds is NOT inevitable, it can be averted quite cheaply and easily. If it does happen it will be because our community has decided, in effect, that it is content for that dismal process to take place.

# A natural vegetation regeneration event

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Rather than writing about the activities of a conservation group and its successes and failures, this is a piece about a spontaneous natural vegetation regeneration event that occurred over a period of some 35 years. It is a demonstration of the power of the soil seed bank, and shows that, given time, some degraded plant communities can heal themselves.

## Site description prior to disturbance

The South Tuross Beach at Tuross Head on the South Coast of NSW is separated from the village of Tuross Head by the mouth of the Tuross River. Under normal conditions, the southern end of the beach abuts the headland north of Blackfellow Point, while the northern end finishes in the outflow of the Tuross River to the sea at the base of Tuross Head. The beach is composed almost entirely of a volatile sand mass that supports conventional coastal sand dune vegetation, with species density and abundance varying according to local climate and habitat conditions.

In the 50 years preceding 1960, the dunes at South Tuross Beach had been reasonably stable, with no major floods or other weather-related disturbances. The southern end of the beach supported a forest dominated by mature *Eucalyptus botryoides* (maybe some *Corymbia maculata* too), most likely with associated coastal species of the area – *Banksia integrifolia, Acacia longifolia* subsp. *sophorae, Monotoca elliptica*, *Casuarina glauca*, *Lomandra longifolia*, perhaps Boobialla (*Myoporum insulare*), *Rhagodia candolleana*, salt resistant grasses as well as other sand binding species.

*Beachcomber Holiday Park and north to the Tuross River estuary and South Tuross Beach from the air, 2005. Photo: Beachcomber Holiday Park.*

Human impacts at the time included use of the area as a fishing campsite, with a little jetty into the lake and small tinnies moored there. There was a track through the forest to the river mouth that allowed for vehicle access.

On the seaward side, *Spinifex sericius* and *Austrofestuca littoralis* protected the dunes from wave-related sand erosion (up to a point), while *Acacia longifolia* subsp. *sophorae*, the daisy *Actites megalocarpus*, and the introduced *Arctotheca populifolia*, among others, occupied the centre. On the estuarine side of the beach, where the river current was slow and meandering, grew *Banksia integrifolia*, *Casuarina glauca, Carex pumila* and *Cyperus littoralis, Isolepis nodosa, Juncus kraussii*, with American Pennywort (*Hydrocotyle bonariensis*), *Zoysia macrantha*, and Couch grass (*Cynodon dactylon*) on the dryer sites.

## Disturbance event

In 1974, a combination of a huge swell, extremely high tides and a flooded river caused the ocean to sweep over the whole of the sandspit, right up to the base of Tuross Head. All the vegetation and most of the sand were washed away, leaving only a few dead and dying large trees. The dead trunks remained standing for about thirty years, when they finally collapsed in high winds.

## Description of vegetation regeneration

The dunes gradually rebuilt, but were initially quite unstable due to the lack of vegetation. This was very slow in regenerating after the flood, with very little increase in plant abundance even by 2000. Added to the havoc wrought by this catastrophic disturbance event, the recovering dunes were subjected to heavy degradation by four wheel drive traffic, mostly driven by fishers, on the seaward beach, through the centre, and on the estuary side.

However, in 1988, when the vegetation was still struggling to establish, the South Tuross sandspit was included in the newly gazetted Eurobodalla National Park. Vehicles were prevented from driving on to the dunes, which greatly assisted plant recovery and improved habitat for several endangered nesting shorebirds, including Pied Oystercatchers, migratory Little and Fairy Terns, common Red Capped Plovers and Hooded Plovers. These birds nest in the sand and the shelter provided by small bushes is essential for the survival of the chicks.

An attempt to revegetate the site and thus stabilise the dunes was conducted at the time of the gazettal of the National Park by the Potato Point Dunecare group. Unfortunately, the area planted was too small to be of any

significance in the long term, and the species used were, for the most part, unsuitable for the conditions and location. In addition, low soil nutrients, an almost complete absence of organic matter, and relatively dry weather following planting probably contributed to plant mortality. For example, planted *Banksia integrifolia* seedlings probably had insufficient organic material to build the proteoid roots that enable the plant to take up soil phosphorus; *Leptospermum laevigatum* is not native to the area and the mineral constituency of the sand was not appropriate; and *Westringia fruticosa* does not usually grow in impoverished sand (it likes a bit of decomposed plant material).

*The ocean surging across South Tuross Beach, 1974. Photo: Greg Underwood.*

*Looking north from Beachcomber Holiday Park, August 2011. Photo: Jennifer Liney.*

Fortunately, this failure had minimal effect on the gradual recuperation of the dune vegetation. Over the next ten years or so, plant species gradually covered the sandspit, particularly *Acacia longifolia* subsp. *sophorae* on the dunes, and *Banksia integrifolia, Casuarina glauca*, and the smaller estuarine margin species on the wet heavier sand at the southern end of the lake. On the beach side and adjacent to the Tuross River mouth at the northern end, *Cakile maritima, Spinifex sericeus* and *Austrofestuca littoralis* encouraged the formation of dunes and swales.

While the river mouth is open, the sand within the estuary is constantly shifting. Islands and shallows come and go, never remaining stable long enough for plants to germinate and mature. But if the mouth closes, it is a different story.

Due to drought conditions in the 2000s, the mouth of the river did close, and remained so for a couple of years. During this time, the vegetation on the estuary side did not suffer any stress due to fast water flows, and consequently became firmly established. A number of mangrove (*Avicennia marina*) plants germinated in the quiet waters; today a few have grown head high. Even some of the sand islands in the estuary proper supported quite a few low growing species; this was especially important for nesting Little and Fairy Terns.

At present the dunes are clothed in a dense mass of *Acacia longifolia* subsp. *sophorae*, with a number of *Banksia integrifolia* and *Casuarina glauca* emerging from the prostrate wattle at the southern end. On the estuary margin at this southern end, there is an almost impenetrable growth of *Isolepis nodosa*. Further away from the water, the sand is held together with the Prickly Couch (*Zoysia macrantha*), *Spinifex sericeus,* Pigsface (*Carpobrotus glaucescens*) and *Suaeda australis*. At the river mouth on the northern end, the dunes are always unstable, changing tides and swell preventing any permanent growth from occurring.

## Conclusion

The South Tuross sandspit is a good example of natural vegetation regeneration, where the soil seed bank was robust enough to provide a stock of viable seed that germinated when conditions were suitable. There have not been any super catastrophic events since 1974 to interrupt the orderly progress from seedling to mature plant. Nevertheless, a repeat of the weather conditions that existed in 1974 could easily destroy the lot again. Who knows how many times this cycle of 'boom and bust' has been repeated over hundreds of thousands of years.

# Community restoration of a degraded wetland in Knockrow, New South Wales north coast

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## Introduction

Knockrow landholders Carmel and Ken McCaffery have achieved their environmental goal of restoring over one hectare of wetland vegetation on their rural property, five kilometers from the coast, near Lennox Head in northern New South Wales. The property had previously been cleared for farming, including a low-lying wetland area which supported little more than introduced pasture grasses. A small spring-fed billabong with an isolated pocket of remnant native vegetation remained, which the McCafferys had been supplementing with native plantings to the best of their ability. Carmel McCaffery had a grander plan, to completely revegetate and restore the degraded wetland. With the assistance of WetlandCare Australia she was successful in securing funding from the Australian Government's Community Coastcare program in 2008. This funding provided over 3000 seedlings and other materials and also paid for the technical assistance of a wetland scientist from WetlandCare Australia to oversee the project, with required labour carried out by the landholders and the local community.

## Revegetation works

The landholder had previously fenced the revegetation area to exclude domestic stock and, prior to planting, the area was prepared with a ripper to loosen and aerate compacted soil. A mix of native wetland species was sourced from a local native plant nursery. The planting list was comprised of wetland plants occurring naturally in the local area, including species of *Melaleuca*, *Eucalyptus*, *Casuarina*, *Leptospermum* and *Callistemon*. Seedlings were planted at 1.5 to 2 metre intervals (depending on eventual tree size) in holes approximately 20 cm diameter by 20 cm deep, with organic fertiliser tablets at the base. Jute matting was placed around each tree to suppress weeds and retain moisture, and corflute tree guards were installed to protect seedlings from wind and native herbivores. Newly planted seedlings were watered regularly for several months until they had become sufficiently established. The various seedling species were planted in zones according to their tolerance to water logging. This design complemented the sloping nature and varying drainage of the site and ensured the development of a natural and functional ecosystem. The revegetation process, from site preparation to completion of planting, was carried out over a period of 18 months.

## Community involvement

The local community was actively engaged in all stages of the project from planning and site preparation to tree planting and maintenance. All labour involved in the planting, including digging holes, carting materials, planting trees, installing jute matting and tree guards and site maintenance, was undertaken by the landholders with assistance from the wider community. The landholders, their extended family and neighbours undertook numerous planting days along with volunteers from the wider community, including environmental science students from the local university. All volunteer planting days were overseen by a wetland scientist from WetlandCare Australia which gave an opportunity for knowledge sharing. Local businesses also assisted with the project by lending or donating equipment and time to prepare the site, dig holes and set up irrigation. About fifty people were involved in the project.

Especially significant was the involvement of a local Indigenous 'green team' from the Australian Government's National Green Jobs Corps initiative, who diligently undertook a large component of the planting work. Participants were studying to gain qualifications in Natural Resource Management as part of the national program, and through this project they were able to attain valuable on-the-job experience to strengthen and apply their skills. This hands-on experience supplemented the team members' learning as they undertook vocational qualifications.

Local landholders, students and local business people involved in rehabilitating this wetland all benefited from sharing knowledge with each other and with wetland scientists. The engagement of the local community increased awareness and understanding of protecting and rehabilitating coastal environments, and enhanced community appreciation for wetland values. They have learned and/or strengthened practical skills in wetland rehabilitation as well as gained an insight into wetland structure and function and the need to protect coastal wetlands. The increased community skills gained in wetland rehabilitation may now be applied to other coastal wetland sites and similar projects implemented based on the best practice principles learned.

*After (left): Landholder Carmel McCaffery at the completed revegetation area, with trees that were planted only a year before this picture was taken. Before (right): The revegetation area before planting commenced. Photos: WetlandCare Australia.*

### Results

The revegetation of this site has been most successful. Due to the tight time-frame of the project some small seedlings had to be planted during less ideal times of the year, such as in hot dry weather and during winter. Many people were volunteers with only basic knowledge of tree planting techniques. Despite this, the newly planted seedlings demonstrated very high survival and growth rates. All native species established exceptionally well, with some specimens growing to heights of over 2 metres in the first year. Additionally, it has been observed that some of the specimens have begun to self-seed. Natural regeneration is occurring within the revegetation area with unplanted native seedlings germinating and establishing without assistance. This natural regeneration is bolstering the manual planting efforts, and suggests that a functional natural ecosystem is already establishing.

The great success of the revegetation completed in this project is attributed to several factors:

- engagement of a qualified wetland scientist to guide the planning and execution
- using species appropriate to the area and zones within the wetland site
- use of adequate and appropriate materials to protect seedlings from weeds, herbivory and the elements
- diligent seedling maintenance by the landholder, including regular watering in hot weather.

### Biodiversity outcomes

This project rehabilitated an area of important but degraded coastal wetland. This included protecting and restoring an area of remnant vegetation surrounding an existing billabong, and densely revegetating 1.5 hectares of adjoining and previously cleared wetland with native species.

These activities have helped to preserve coastal biodiversity and threatened species. Valuable habitat within the local area has now been enhanced, much of which was fragmented and cleared of native vegetation. The establishment of a large section of native vegetation adjacent to an existing wetland with permanent water is likely to provide valuable habitat refuge for native animals, providing sources of food, shelter and nesting places. Habitat potential for native vegetation species has also been increased, as shown by the emergence of self-sown native seedlings.

The completed wetland revegetation will help to combat stream bank erosion and watercourse siltation as trees grow and root systems develop. It will also reduce degradation caused by acid sulfate soils, leading to downstream benefits in water quality.

The revegetated area has also contributed to combating the broader effects of climate change on coastal environments by offsetting carbon dioxide emissions and providing refuge habitat with space for adaptation over time. This project has improved the aesthetics of the area and may act as an inspiration to other landholders to undertake revegetation works on their own land. For further information please contact WetlandCare Australia (www.wetlandcare.com.au), who for over 20 years has been dedicated to supporting every Australian to protect and restore wetlands.

# Continuing development of an area of Australian plants at Mallacoota, Victoria

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Several years ago I wrote an article on the history of a double block of land at Mallacoota, a town in Victoria on the coast, just over the border from New South Wales (Anderson 2008, 2009). The purpose of this article is to continue with the story of this land up to the present.

## The early days

The history of the double block is that when I purchased it in 2000 it was cleared to ground level as part of a larger subdivision. There were stories in Mallacoota that the people who owned it years ago had wanted the whole area of eight building blocks to have some sort of conservation status, but that did not happen.

Over the succeeding years since the purchase I have been pleasantly surprised with what has appeared from the seed bank in the soil on this block. It includes a high density of Kangaroo Grass (*Themeda triandra*), some Blady Grass (*Imperata cylindrica*), native orchids including *Thelymitra ixiodies* and onion orchids (*Microtis* sp.), several wattles, *Kennedia rubicunda* and Victorian Heath (*Epacris impressa*).

Some eucalypts also emerged, including White Stringybark (*Eucalyptus globoidea*) as well as Rough-barked Angophora (*Angophora floribunda*).

A major step taken several years ago was to fence the area on three sides while retaining an unimpeded view of the lake and ocean on the fourth. Some pieces of surplus Radiata Pine left on the block were used to help construct several seats facing the lake, sea and town of Mallacoota. The fence has been beneficial in giving a sense of human and conservation purpose to the block, which had previously been used as a short cut for pedestrians commuting between their houses and the shops.

There is a requirement from the responsible Shire Council that grassy areas in Mallacoota must be cut at least once a year, often in December, to reduce the fire risk. This has been done each year on the block except for certain pegged-out areas, which can continue to be a local seed source for local plants. The regular cutting helps to maintain good quality Kangaroo Grass on much of the block and keep the potentially invasive local shrub *Kunzia ambigua* under control. Any remaining and emerging patches of Kikuyu, now almost completely confined to the nature strips, are gradually being eliminated, mainly with the assistance of herbicide.

## The story continued

The block now has the name *Themeda Park* on the front gate. Members of the public are welcome to visit and use the seats.

There have not been many plantings on the block because there has not been much need, due to the rich flora that has emerged from the soil seed bank left after clearing.

## *Brachychiton* plantings

I took the liberty of planting a Kurrajong (*Brachychiton populneus*) and a Queensland Bottle Tree (*B. rupestre*) on the bottom nature strip. I have only found one Kurrajong growing in Mallacoota and no Queensland Bottle Trees. They could both grow quite well in the conditions there and look distinctive. On the top nature strip I have planted another Kurrajong and a closely related Illawarra Flame Tree (*B. acerifolius*) which has been slow to grow after some snail damage. There are other Illawarra Flame Trees planted in Mallacoota.

## *Ficus* plantings

With an interest in native figs I have planted a Sandpaper Fig (*Ficus coronata*), a local plant, near the bottom nature strip. It has been slow to grow but has survived. I have also planted a Port Jackson Fig (*F. rubiginosa*). As mentioned in Anderson (2007) this fig is growing in Mallacoota in a

*The front of the Mallacoota block. Photo: I. Anderson.*

number of places though whether they are planted or the species is endemic is debatable. It is known to occur just over the border in New South Wales. On a bird watching trip to Sri Lanka in 2010 I learned how valuable fig trees are, especially as habitat and food for birds. They are considered sacred in the local religions there.

*The tree (left) that germinated from the soil seed store may be a Victorian Eurabbie (*Eucalyptus globulus *subsp.* pseudoglobulus*). Photo: I. Anderson.*

### Local eucalypts

I have allowed a few individual plants of the eucalypt species which have germinated from seed on the block, after I bought it, to continue growing. One such species is White Stringybark (*Eucalyptus globoidea*). Another eucalypt tree has not yet fruited but appears from its form and leaf size and shape to be the Victoria form of Tasmanian Blue Gum (*Eucalyptus globulus* subsp. *pseudoglobulus*), commonly known as Victorian Eurabbie.

A local naturalist mentioned some time ago that the Victorian Eurabbie used to be found in the Mallacoota area but has almost completely died out or been felled. Few if any are left apart from perhaps a long lived hybrid or two. They are apparently more common in the Cann River District south of Mallacoota. It is pleasing to think that a few of them may have the chance on *Themeda Park* to grow to maturity and perhaps produce some seed.

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# The TSR Network: linking places, linking people

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The travelling stock routes and reserves (TSR) network in New South Wales is an extensive network of public land that was established for droving sheep and cattle during early European colonisation. Unlike much of the surrounding agricultural land, TSRs were not extensively cleared, and their management history has left them with unique environmental values.

The TSR network protects high-quality remnant vegetation communities that are not well represented in the National Parks estate, particularly communities that are adapted to the fertile soils of valley floors where TSRs are often located. The network provides a refuge for many threatened species and ecological communities, and for the declining woodland bird populations of central NSW.

TSRs form important corridors and stepping stones of habitat across the landscape of NSW. Together with the stock routes in Queensland, they form a unique network of habitat linking much of eastern Australia, and allowing movement of species across the landscape in response to seasonal extremes, shifts in resources and climate change.

TSRs also have economic, cultural and social value. They are economically important to users like graziers and drovers, particularly in times of drought. TSRs are also rich in Aboriginal and droving culture and heritage and are important areas for recreational activities such as angling, cycling and bird watching.

The National Parks Association of NSW (NPA) has been working for more than 50 years to keep TSRs in public

hands and protect their unique ecological and cultural values. In 2008, the inaugural NSW TSR conference was held in Sydney. At the beginning of this year, in light of another promised government review of the authorities that manage TSRs, as well as ongoing concerns about threats such as coal seam gas pipelines, weeds, illegal firewood collection and rubbish dumping, we decided to convene a second TSR conference.

### The 2011 NSW Travelling Stock Routes and Reserves Conference

The second NSW TSR conference took place on 28th July, 2011, in the regional centre of Orange. Approximately 100 delegates attended, representing a range of different stakeholder groups including government agencies and departments, Aboriginal groups, recreational users, conservationists, farmers and researchers. All the delegates were interested in how TSRs could be managed to protect their many values and to promote the shared and sustainable use of the network.

A key element of the conference was the formation of six discussion groups, reflecting the different challenges for TSR management:

- management of understorey values
- management of overstorey values
- management of culture and heritage values
- management of recreational values
- management of economic values
- resourcing and governance.

Each group considered the threats to TSRs, opportunities and possible management solutions relevant to their area of discussion. Groups then identified key priorities for TSR management, and reported these back to the conference.

There was a broad consensus throughout the day that communication and connection amongst groups and people with an interest in TSRs needs to be maintained and increased. During the plenary session, there was general agreement to five key requirements for effective management of the TSR network. They were:

- An authority with oversight of TSRs that has stable and adequate resourcing for the task. This could build on existing institutional arrangements.
- Accessible data, collating and extending on currently available information about TSRs, in a more coordinated and streamlined format.
- Representative management that brings together the various values and interests and facilitates networking and information sharing.
- Educational programs to raise awareness of the wide importance of TSRs and their permitted uses, and help recognise and protect their Aboriginal and droving cultural heritage.
- An assessment of the economic significance of TSRs using a framework (such as Total Economic Value) that incorporates their full range of economic, social, cultural and environmental values.

*Aerial image showing a TSR 'corridor' across the NSW landscape. Photo: Cecile van der Burgh.*

*Scarred tree on Grogan TSR, NSW. Photo: Rosemary Stapleton.*

## Where to from here?

### Working Group

A working group is being formed by conference participants to continue the work of the conference in developing a management framework for TSRs, building on the discussion group sessions and the five key management requirements identified. The working group will consult with stakeholder reference groups to ensure that the framework developed is inclusive of the wide range of groups with an interest in shared, sustainable use of TSRs.

### Livestock Health and Pest Authorities Review

The new State Government is currently fulfilling its election promise to review the Livestock Health and Pest Authorities (LHPAs), which manage the majority of TSRs in the Central and Eastern Divisions of NSW. These authorities are unique to NSW, and have been operating for approximately 150 years in various incarnations. LHPAs currently have a wide range of functions including livestock health programs, control of pests on rural land and administration of drought and disaster relief schemes, as well as the management of Travelling Stock Routes and Reserves.

A discussion paper for this review was released on 5th September, 2011. The discussion paper does not have a strong focus on TSRs, but does pose the question of whether *"... the maintenance of certain Crown lands as Travelling Stock Reserves [is] justified on net public benefit grounds"*. NPA has made a submission to this review arguing strongly that the maintenance of the TSR network is justified by the very high ecological, social, cultural and economic benefits of the network, and that public funding should support the management of the network by a single, stable, well-resourced authority.

## Combating the threats from coal seam gas activities

Coal seam gas-related activity, particularly the construction of long-distance gas pipelines, was identified at the 2011 conference as an imminent threat to TSRs. Gas companies and the NSW government have indicated that they strongly support the use of TSRs and other public land for pipelines wherever possible.

This is of great concern to those who value TSRs, as on some of the narrower routes, clearing for pipelines could destroy all the mature vegetation, with devastating impacts on the ecological and heritage values of the TSR, and the connectivity of the network as a whole. There is also concern that this development might set a precedent for the use of TSRs for pipelines and other infrastructure networks across NSW. NPA has made a submission to the recent NSW inquiry into coal seam gas, emphasising that coal seam gas activities and infrastructure must not be allowed to compromise the integrity and values of the TSR network.

## Conclusion

The TSR network has the potential to link not only habitat patches, but also a wide range of people. The 2011 TSR conference provided a good opportunity for diverse stakeholder groups to come together and begin sharing their experience and knowledge. NPA hopes that these groups will continue working together to combat the ongoing threats to TSRs, and ensure that they are sustainably managed for their many values and uses.

For further information about the 2011 NSW Travelling Stock Routes and Reserves conference and updates on various issues affecting TSRs, visit www.npansw.org.au.

*Fringe-lily and native bee on Gara TSR, NSW. Photo: Kate Boyd.*

*Healthy vegetation community on TSR between Nyngan and Bourke, NSW. Photo: Anthony O'Halloran.*

# Obituary: Vale Anders Tony Bofeldt

## 11 December 1962 to 30 June 2011

*Maria Matthes and Mark Robinson*

Anders T Bofeldt, well known and well-respected plant conservationist, particularly for his work in rainforest conservation and threatened species, died in his beloved Illawarra on the 30th June 2011, aged 46.

Anders' untimely death has left a big hole in rainforest knowledge and a huge gap to be filled. He was one of southern Australia's best rainforest field botanists, and certainly the best the Illawarra has and probably ever will see in a long time – as few have as much field time as Anders who was constantly searching the bushland and its flora. All who knew him will share in the loss of a friend and a teacher.

Anders unexpectedly passed away as the result of a complicated infection, beginning with a spike from a Canary Island Date Palm. It was only on his passing that his mother revealed the irony that he was conceived on the Canary Islands. Despite this, he hated the species, outraged that it was allowed to be planted in subdivisions, and was now an environmental weed in many of the Illawarra's remnant bushland … recently complaining that he was always getting spiked when pulling it out.

We were privileged to have had Anders Bofeldt in our lives, whether it was to share in his extensive botanical lore, or to share our journey into the plant kingdom, he encouraged you professionally to keep at your work to help the environment, often leading to great discussions exploring conservation issues. Those who spent time with Anders couldn't help but be in absolute awe of not only his wealth of knowledge as a botanist, but also as an ecologist and evolutionist. It is with understanding that he was a walking encyclopedia when it came to flora of rainforest and other habitats in eastern Australia, that we also mourn the loss of all the knowledge that Anders would have documented if he had lived a longer life. We are also reminded of all the unanswered questions that we had put off asking him until a later time, questions that will perhaps forever remain unanswered.

The legacy Anders left is nothing less than enormous. Anders spent his life increasing his knowledge from his teenage years until his death, he had a particular penchant for rainforest plants but was also adept at identifying hundreds of other taxa. Anders explored their biology (especially reproductive biology and floral structure), gathered knowledge of their ecology, detailed know-how in their propagation, how to store their seed and how to conserve them. This information was a valuable addition to the Royal Botanic Gardens (Sydney) project

*Anders Bofeld, one of southern Australia's best rainforest field botanists. Photo: Jedda Lemmon.*

'Ecology of Sydney Plant Species', published in the journal Cunninghamia, and contributes to information on the RBG's PlantNet website, the Illawarra biodiversity strategy, various university student publications, and in the hundreds of plant survey lists, many of which were done for community groups to help them manage, conserve or even defend their remnant bushland against greedy developers.

Anders' passion and excitement for threatened species, new discoveries and extending the known limits of species was inspirational to say the least. His astute observation and ability resulted in the discovery of dozens of plant species that were either not previously found in the Illawarra, or thought to be extinct. Examples of his discoveries include:

- the only Illawarra populations of the endangered Brush Senna (*Senna acclinis*) where its reaches its southern geographic limit (recorded in 1986)
- Numerous new populations of endangered White-flowered Wax Plant (*Cynanchum elegans*)
- Several large populations and the northern geographic limit of Illawarra Socketwood (*Daphnandra* sp. C) a narrow endemic
- Silver Aspen (*Acronychia wilcoxiana*) growing in Primbee at least 160km south of its known distribution (recorded in 2005)
- the only records of Native Quinine (*Alstonia constricta*) in the Illawarra, disjunct by approximately 580 km to the next population near Coffs Harbour

- Sticky Daisy (*Adenostemma lavenia*) recorded in 2005 growing at Bellambi Lagoon (Illawarra) at its southern limit, a species more common north of Buladelah but with an old record at Botany Bay.

The 1999 rediscovery of *Grevillea rosmarinifolia* at its Type location (location on which original description of the species is based) despite targeted surveys by Grevillea experts in the late 1960s, early 1970s and in 1999. On a trip to Canberra, Anders wandered away from the group he was with, returning to ask "what's this?", only to have rediscovered the species in the wild.

We would like to finish with a quote by Anders from 1993, a lasting message to remind us of why we do what we do:

*"What we've lost is nothing short of a national tragedy but what is done is done. The question now is how are we going to conserve (protect) what's left?... comment on the massive habitat loss and clearance of Illawarra's vegetation over the last 200 years"*

Thank you, our friend, forever in our hearts and on our rainforest jaunts, we will miss you.

# ANPC in the USA: directions in science and conservation at the Smithsonian Institution

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I am currently a visiting assistant professor at Sweet Briar College, Virginia, USA, having just completed a two-year postdoctoral fellow at the Smithsonian Environmental Research Center (the Center), Edgewater, Maryland, USA. This regular report covers some of my experiences in environmental research in the United States and provides recent highlights in science and conservation there. An introduction to this regular report and background on the Center can be found in issue 18(2) of *Australasian Plant Conservation* (September—November 2009).

## Southern migrations

It's once again that time of year when the trees begin to signal the onset of cooler weather by turning their foliage into a collage of autumn colours and northern folk begin to pack up their trailers and prepare for their annual migration south toward Florida. I have been similarly lucky to extend both my summer and my stay in the US by moving south to Virginia to undertake a one-year lecturing position in biology at a small rural college. Since the campus provides an expanse of natural and modified landscapes for developing field-based classes, I am busy measuring and recording local wildlife in preparation for the start of semester. This includes estimating population size of freshwater crayfish, attempting pitifully to catch fish, documenting the local flora, and monitoring the annual migration of Monarch Butterflies. The butterflies are about due to arrive from their summer hangout in northern USA and Canada, to pit-stop for nectar refills on their journey to Mexico where they will spend the winter. Monarchs make a wonderful study species for feeding experiments in the classroom. They are easily caught (contrary to popular belief, handling them doesn't harm them. Unlike some butterfly and moth species, Monarchs don't easily lose scales when held) and can be encouraged to taste different sugary treats by unrolling their proboscis and letting them lap at a capillary tube full of food. So far, I've only recorded Swallowtails but I'm eagerly anticipating the arrival of the first Monarchs to our garden of aptly named Butterfly Bush (*Buddleja davidii*).

## Scientific teaching: engaging students in the process of science

Students' abilities and learning styles vary substantially, and are known to influence their ability to acquire and utilize knowledge (National Research Council 1999). Therefore, the standard lecture format is recognized as insufficient for embracing the learning requirements of all students (Handelsman et al. 2007). Recently, there has been a push for a national reform of undergraduate science education in North America (e.g. Ebert-May et al. 2004), to improve student engagement in science through active learning and assessment. In response, The Ecological Society of America provides access to best practices and guidelines for teaching and learning, including education workshops at annual meetings, NSF-funded web resources such as Teaching Issues and Experiments in Ecology (TIEE 2004), and professional development opportunities such as Faculty Institutes for Reforming Science Teaching (https://www.msu.edu/~first4/Index.html). The journal *Frontiers in Ecology and the Environment* also includes an education series entitled "Pathways to Scientific Teaching" which comprises articles that focus on active learning, inquiry-guided instruction, and assessment.

## Science and conservation highlights

### Northern-migrating Mangroves

While Northern Americans focus on migrating south for the winter, Floridian Mangrove forests are gradually making their way northward, as global temperatures rise. Researchers at the Center are combining field work with satellite data provided by NASA to track Mangrove movement in North America, Florida, Panama, Belize and Australia. Mangrove migration could potentially displace salt marshes in their overlapping ranges, impacting carbon sequestration, nutrient flow and biodiversity.

### Improving predictions of biodiversity responses to climate change

Predicting responses of biodiversity to climate change is a major focus of ecological research but remains remarkably challenging. McMahon et al. (2011) outline five ways to substantially improve our knowledge in the near future using improved modelling approaches: "(i) improving the accessibility and efficiency of biodiversity monitoring data, (ii) quantifying the main determinants of the sensitivity of species to climate change, (iii) incorporating community dynamics into projections of biodiversity responses, (iv) accounting for the influence of evolutionary processes on the response of species to climate change, and (v) improving the biophysical rule sets that define functional groupings of species in global models."

### Increases in tropical forest growth is associated with the release of stored soil carbon

Results from a six-year experiment in a rainforest at the Smithsonian Tropical Research Institute in Panama have shown that increases in litterfall from trees can stimulate carbon decomposition by micro-organisms and thereby increase the amount of respired carbon from soil. Sayer et al. (2011) estimate that a 30% increase in litterfall could release about 0.6 tonnes of carbon per hectare from lowland tropical forest soils each year, which could affect the global carbon balance. This study demonstrates the importance of considering the impact of interactions among plants and soil organisms for estimating the carbon sequestration capacity of tropical forests.

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Shorelines: blog of the Smithsonian Environmental Research Center: http://sercblog.si.edu/?p=1111#more-1111

TIEE (2004) Teaching Issues and Experiments in Ecology: http://tiee.esa.org/

Additional resources for scientific teaching: https://www.msu.edu/~first4/Resources.html.

# Report from New Zealand Plant Conservation Network

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### Global Partnership for Plant Conservation conference

In July, committee member John Sawyer attended the Global Partnership for Plant Conservation conference held in St Louis, Missouri. The theme was to hear about worldwide implementation of the Global Strategy for Plant Conservation and to plan the next steps towards achieving its objectives. It was clear that New Zealand was doing their part in protecting native plants and implementing the Global Strategy, but we still have a long way to go.

### Marae base plant training course

The Network delivered its first marae base plant training course in 2006. The program was created to enhance the knowledge among Maori people of our unique flora and the marae – a place for meeting/gathering – were an ideal setting for them. Introduction to Plant Life in NZ was the first module. Covenant Management is the second module and the third training module is now available. How to grow native plants and manage a plant nursery covers plant nursery management, cultivation of NZ plants and different propagation techniques. These are all available through our website.

### Website updates

Two new additions have been made to the website. A new PDF maker has been added to the website that allows users to convert plant species webpages into files for downloading and printing. Click on the 'Download Factsheet' link on a species page. This will automatically download a PDF document which can be saved to your computer or printed.

Flower colour has been added to the flora search on the Network website, allowing users to narrow the search for a plant. Almost all native and exotic species have been added to the website and more work is being done on it.

Hope you have been testing yourself with the quiz.

Visit www.nzpcn.org.nz for more information

# Research Roundup

*Compiled by Kirsten Cowley, Centre for Plant Biodiversity Research, Canberra. Email: Kirsten.Cowley @csiro.au*

Adams, M.P., Smith, P.L. & Beattie, A.J. (2011). **Impact of spatial disjunction within biophysical classes on plant species composition: implications for conservation planning.** *Austral Ecology* 36: 453–60.

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# Research Roundup (cont.)

Lentini, P.E., Fischer, J., Gibbons, P., Lindenmayer, D.B. & Martin, T.G. (2011). **Australia's Stock Route Network: 1. A review of its values and implications for future management.** *Ecological Management & Restoration* 12(2): 119–27.

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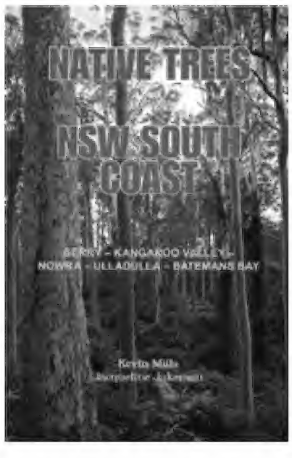
Contributions to Research Roundup are welcome, and should be sent to Kirsten Cowley at the above email address using an email subject heading "APC Research Roundup" or similar. Their inclusion will be subject to available space.

# Book Review

## Native Trees of the NSW South Coast: Berry– Kangaroo Valley – Nowra – Ulladulla – Batemans Bay

*Kevin Mills & Jacqueline Jakeman*
*Envirobook, 2010, 246 pages*
*Paperback ISBN: 9780858812307, AU $ 34.95*




Plant identification books for me are useful tools. I open them at the plant I think I have in front of me or search through related ones. I rarely read the introductory chapters. However as a reviewer I felt obliged to actually read this one from cover to er … almost cover, and I have been a little surprised. The introductory chapters are a pleasure to read; the direct writing style provides a commentary on the plants and the landscape in the way that a botanist would present to a group of visitors or students when they are out in the bush. Beginning with the climate and geology of the South Coast, the authors continue with the nature of trees – tree size, distribution, climatic and geological factors important for the distribution of native trees. Chapters cover the main tree groups providing good readable descriptions of the main bark-type groups of the 47 eucalypt species of the South Coast, and includes a mention of Old Blotchy, a Spotted Gum (*Corymbia maculata*), that may well be the tallest tree on the south coast (I didn't know about him). Separate introductions are provided to the tree size wattles (37 species), paperbarks (12 species), she-oaks (8 species) and rainforest trees (76 species). That 36% of the 169 native species are at their southern limit of distribution in the area is highlighted

# Book Review (cont.)

and the species listed. As well there are short informative boxed-sections including slight digressions on botanical illustration, plant names and Red Cedar (*Toona ciliata*).

The final introductory chapter allows you to relate to the trees of your particular South Coast area. So if Kangaroo Valley, Berry, Nowra, Jervis Bay, Sussex Inlet, Milton, Bawley Point or Batemans Bay is your home or holiday area, there is something here for you.

Finally the individual single-page plant descriptions of the 169 species, each with a careful line drawing (there are also a number of coloured photos), make up the bulk of the book. Species are grouped by rainforest, forest, woodland and coastal categories. I particularly like the authors' consistent use of the conjunction of common name and botanical name throughout the book, as in Deciduous Fig (*Ficus superb*a) or Blue-leaved Stringybark (*Eucalyptus agglomerata*). As a dedicated user of botanical names I find the use of common names alone irritating, though I understand that particularly for trees common names are a dual currency.

Kevin Mills and Jacqueline Jakeman provide more than just an identification guide. In an easy-to-read format they convey much of what they have observed and learnt from many years of ecological study in the area. And doubtless they have had books fall to bits under the rigours of constant use. They have designed this book to fit into a pocket or pack and made it section-sewn so that it shouldn't fall to bits just as you begin to get to know your trees.

Native Trees of the NSW South Coast is available through regional bookshops (South Coast) and botanical bookshops in Sydney and Canberra. Also direct from Envirobook: 5/168 Jacobs Drive, Sussex Inlet NSW 2540; Fax 02 4441 2004; Phone 0401 427 032; Email: pat@envirobook.com.au

*Review by Doug Benson, Senior Plant Ecologist, Royal Botanic Gardens Sydney*

# Information Resources and Useful Websites

### Caring for the Coast: A guide to environmental law for coastal communities in NSW

*Environment Defender's Office*

The Environmental Defender's office (NSW) has produced a publication dealing with threats to coastal environments and how coastal communities can use the law to achieve better environmental outcomes. The publication is a plain English guide to the key laws affecting the coast and contains lots of tips on how these laws can be used by the public to help protect the coast. The publication has been funded by the Commonwealth Government through its Caring for Our Country program. To order your free copy, email education@edo.org.au or call 02 9262 6989.

### Conserving biodiversity in Brigalow landscapes

*C. McALpine, M. Maron, G Smith, 2011*
*www.gpem.uq.edu.au/brigalow*

The University of Queensland have produced a report on the conservation of biodiversity in the Brigalow landscape. Although its focus is fauna conservation, this has implications for vegetation management.

### Victorian NatureShare website launched

*http://natureshare.org.au/*

A new website has been developed that will help document changes to Victoria's natural environment. The website allows users to document observations on their property and the bush around them. Developers of the new website hope it will become a storehouse of the huge amounts of knowledge collected everyday by individuals and conservation groups across Victoria.

### Celebrating Victoria's Nature – orchid diversity

*http://www.victorianaturally.org.au/page.php?nameIdentifier=flowerpowerallyouneedisalittlelove*

Celebrating Victoria's Nature is a new series that celebrates Victoria's incredible natural diversity. It has been launched with a look at the state's native orchids. You can read Flower Power online. And make sure you're alerted as soon as the next article is published by following Celebrating Victoria's Nature on Facebook.

# Information Resources and Useful Websites (cont.)

### New report: If a tree falls – Compliance failures in the public forests of NSW

*Environment Defender's Office*

*http://www.nccnsw.org.au/media/new-report-unearths-systemic-illegal-logging-practices-nsw%E2%80%99s-native-forests*

The Environmental Defender's Office (NSW) has produced a report, commissioned by the Nature Conservation Council of NSW, on compliance failures in the public forests of NSW. The report includes findings that environmental regulations, intended to prevent unsustainable logging and protect threatened species, are frequently and systemically breached in NSW's native forests.

### Proposed law for accreditation of eco-consultants in New South Wales

*http://www.parliament.nsw.gov.au/prod/parlment/nswbills.nsf*

The NSW Greens have introduced a private member's bill to the NSW parliament to amend the *Threatened Species Conservation Act 1995* (NSW) ('TSC Act'). The new Threatened Species Conservation Amendment (Ecological Consultants Accreditation Scheme) Bill 2011, introduced on 5th August, would establish a new Part 8A of the TSC Act, to "establish an accreditation scheme for ecological consultants preparing or carrying out certain assessments, impact statements or surveys" under the TSC Act, the *Fisheries Management Act 1994* or the *Environmental Planning and Assessment Act 1979*.

### Invasive and Introduced Plants and Animals Human Perceptions, Attitudes and Approaches to Management

*Ian D Rotherham, Robert A Lambert*
*CSIRO Publishing, May 2011, 352pp*
*Hardback, ISBN 9781849710718, AU $122.00*

There have been many well-publicised cases of invasive species of plants and animals, often introduced unintentionally but sometimes on purpose, causing widespread ecological havoc. This book addresses the broader context of invasive and exotic species, in terms of the perceived threats and environmental concerns which surround alien species and ecological invasions. Copies of the books are available from http://www.publish.csiro.au/pid/6796.htm

### Making Nature Whole - A History of Ecological Restoration

*William R Jordan III, George Lubick*
*CSIRO Publishing, July 2011, 319pp*
*Paperback ISBN: 9781597265133, AU $55.95*

This book presents an in-depth history of the field of ecological restoration as it has developed in the US over the last three decades. The authors draw from both published and unpublished sources, including archival materials and oral histories from early practitioners, to explore the development of the field and its importance to environmental management as well as to the larger environmental movement and our understanding of the world. Useful for anyone interested in understanding where ecological restoration came from or where it might be going. Copies of the books are available from http://www.publish.csiro.au/pid/6773.htm

### Introduction to Restoration Ecology

*Stephen B Glass, Evelyn A Howell, John A Harrington*
*CSIRO Publishing July 2011, 464pp*
*Hardback ISBN 9781597261890, AU$120*

Restoration ecology is a young field that integrates theory and knowledge from a range of disciplines, including the biological, physical, and social sciences as well as the humanities. This book offers a real-life introduction to the field and an interdisciplinary overview of the theory behind it. It provides a framework that can be used to guide restoration decisions. Copies of the books are available from http://www.publish.csiro.au/pid/6774.htm

# Conferences and Workshops

### Jewels in the Landscape
### Managing significant native vegetation remnants
(including travelling stock reserves, road easements and adjacent private land)

*3 & 4 November*
*Guyra, near Armidale, NSW*

The next ANPC workshop on managing native vegetation in Travelling Stock Reserves will be held in Armidale. This aim of this workshop is to engage on-ground managers of travelling stock reserves (TSRs) to increase their ecological knowledge and plant conservation skills. Course materials will also be developed as a resource for further workshops and other training opportunities outside the project funding and which could also be applied to other linear reserve management. For further information: see the article on page XX of this issue, or contact ANPC office on phone 02 6250 9509 or email anpc@anpc.asn.au.

### Stipa Native Grasses Association
### 7th National Grassland Conference

*9 & 10 November 2011*
*Holbrook*

Stipa is an organisation formed by concerned landholders and focused on the practical aspects of native grasses and their use in farming The theme of the conference is "Managing Native Grasslands for Soil and Animal Health. For further information contact Graeme Hand, mob. 0418 532130 E. graeme.hand@bigpond.com

### Grassland Management Conference

*10 & 11 November 2011*
*Wyndham, VIC*

The 2011 Grassland Management conference aims to increase coordinated and effective management of grassland species to create diverse and resilient grasslands. The conference will bring together a range of experts, project officers and representatives from agencies and organisations who have a focus on grassland management and conservation. This is an opportunity for those managing biodiversity in the plains to share research and techniques, create networks and to enhance their grassland management knowledge. For more information visit http://www.wyndham.vic.gov.au/environment/environmentsustainability/eventsprograms

### 20th NSW Coastal Conference

*8 – 11 November*
*Tweed Heads*

This year the conference program will focus around the lessons learnt from the past 20 years and how that experience can be used to shape our response to challenges in the coastal zone over the next 20 years. For more information visit the conference website www.coastalconference.com.

### 2nd World Conference on Biological Invasions and Ecosystem Functioning (BIOLIEF 2011)

*21–24 November 2011*
*Mar del Plata, Argentina*

BIOLIEF 2011 will be a forum for the presentation, discussion, and synthesis of research on biological invasions in its broadest sense. The conference will place a particular emphasis on studies concerning the impact of invasive species on ecosystem functioning and/or services, irrespective of taxonomic groups or ecosystem types. However, studies on any other ecological aspect of biological invasions will also be welcome. Topics such as the spread of invasive species into ecosystems, the biogeography and history of species introductions, and the community- or species-level impact of biological invasions will also have an important coverage in the final conference program.

Further information: www.grieta.org.ar/biolief/

### 2011 Annual Conference of the Ecological Society of Australia
### Ecology in Changing Landscapes

*21–25 November 2011*
*Hobart, Tasmania*

The theme of the conference encompasses all natural systems, from terrestrial to freshwater and marine, and from the molecular to the ecosystem level. The aim of the conference is to inspire challenging dialogue across all fields of ecology and to link ecological research with practical conservation biology. Symposia will address areas such as Ecology of extreme environments; Thresholds and resilience—retaining, restoring and recreating ecosystems in changing landscapes; Politicising ecology—linking ecology, policy, planning and politics; Integrating patterns, processes and scale in changing landscapes; Species extinction and range changes; Ecosystem services; Genes to ecosystems; Pests and diseases; Island ecology; Reserve challenges—the role of private property conservation. Further information: http://esa2011.org.au

### 25th International Congress for Conservation Biology, Engaging Society in Conservation

*5 – 9 December 2011*
*Aukland, New Zealand*

Biodiversity around the world continues to decline at an ever-increasing pace, yet much of society carries on business as usual. This congress will address how conservation biologists can engage with society to achieve positive outcomes for conservation without compromising our scientific rigour or integrity. Further information: www.conbio.org/2011/

# ANPC Corporate Members

*ANPC gratefully acknowledges the support of the following corporate members*

**Albury Botanic Gardens, NSW**

**Approvals and Wildlife Division, Department of Sustainability, Environment, Water, Population and Communities**

**Australian National Botanic Gardens, ACT**

**Botanic Gardens of Adelaide, SA**

**Botanic Gardens Trust, NSW**

**Brisbane Botanic Gardens, QLD**

**Department of Environment and Conservation, WA**

**Department of Primary Industry, NSW**

**ForestrySA**

**Mackay Regional Botanic Gardens, QLD**

**Redland City Council, QLD**

**Royal Botanic Gardens Melbourne, VIC**

**Royal Tasmanian Botanical Gardens, TAS**

**Sydney Olympic Park Authority, NSW**

**University of Melbourne, Burnley Campus, VIC**

## Myrtle Rust - update

The recently arrived Myrtle Rust pathogen is now well established along the east coast from Nowra to Gympie. 107 native species of the Myrtaceae family are now recorded as known hosts in the wild or in open cultivation. Some are prone to severe infection. Further expansion of its geographic and host range is to be expected this summer. Domestic quarantine restrictions on trade and transport of Myrtaceae to other States are in force.

Key websites for host images, quarantine and hygiene, and management options:

- DPI (NSW): www.dpi.nsw.gov.au/biosecurity/plant/myrtle-rust
- DEEDI (Qld): www.deedi.qld.gov.au
- DPI (Vic) http://new.dpi.vic.gov.au/forestry/pests-diseases-weeds/diseases/myrtle-rust

People in the Myrtle Rust zone can make a crucial contribution to our knowledge of this disease by monitoring its behaviour and the response of plant species. The *Atlas of Living Australia* (www.ala.org.au) is preparing a national 2-way Myrtle Rust information portal, likely to be launched by late November – this will provide easy 'citizen science' guidance on how to monitor and report your observations.

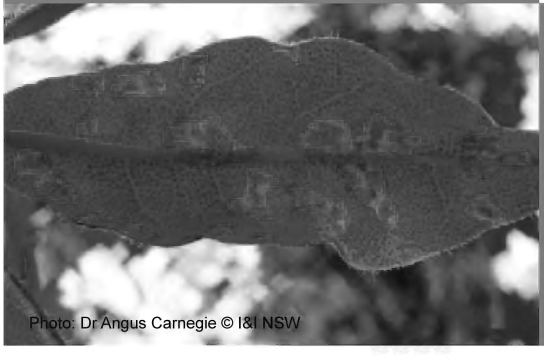


Photo: Dr Angus Carnegie © I&I NSW

## ANPC Myrtle Rust training course

ANPC's Myrtle Rust training course has so far been delivered at ten venues in regional NSW, with 271 people attending and very positive evaluations.

The one-day course 'Myrtle Rust – a new threat to Australia's biodiversity' is being presented by ANPC in association with the Royal Botanic Gardens (Sydney), with the Meat Industry Training Advisory Council Ltd (MINTRAC) as administrative partner. The course has been supported financially in NSW by the National Parks & Wildlife Service.

Three further NSW courses are being finalised for November-December – date and venue details will be posted at www.anpc.asn.au as soon as available, or register your interest now to anpc@anpc.asn.au or phone (02) 6250 9509.

A revised, interstate version of the course suitable for other States is nearly finalised, and ANPC is liaising with agencies and others in those States before finalising dates. (An exception is Victoria, where DPI intends rolling out training for all stakeholders – details will be linked from http://new.dpi.vic.gov.au/forestry/pests-diseases-weeds/diseases/myrtle-rust when available).

ANPC members and supporters in States other than NSW and Victoria can help us to deliver this course nationally by encouraging land management and biodiversity organisations to forward expressions of interest in attending, or helping to put the course on tour, to anpc@anpc.asn.au, or for more information contact bob.makinson@rbgsyd.nsw.gov.au.

### Some comments from attendees' evaluations:

*"Great structure, excellent delivery"*

*"Lots of time to discuss our specific situations"*

*"It actively looked for local solutions to local issues"*

*"Clear and concise … very informative and comprehensive"*

*"The manual is a great resource to take back"*

*"I now have a lot more information which I can take back to share with bushcare volunteers and council staff"*

Australian Network for Plant Conservation Inc (ANPC)

# 9TH NATIONAL CONFERENCE

## Save the date

*for the Australian Network for Plant Conservation's 9th National Conference in it's 21st year!*

**Tuesday 30 October to Friday 2 November 2012**
**Canberra ACT**

www.anpc.asn.au







Australasian Plant Conservation
BULLETIN OF THE AUSTRALIAN NETWORK FOR PLANT CONSERVATION INC

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